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Michal Hošek (1,2), Tomáš Matys Grygar (1,2), Jan Popelka (2), Timea Kiss (3), Jitka Elznicová (2), and Martin Faměra (1)

(1) Institute of Inorganic Chemistry AS CR, vvi, Praha, Czech Republic (hosek@iic.cas.cz), (2) Faculty of Environment, J. E. Purkyně University in Ústí nad Labem, Czech Republic, (3) Faculty of Geography and Earth Sciences, University of Szeged, Hungary

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Michal Hošek (1,2*), Tomáš Matys Grygar (1,2), Jan Popelka (2), Timea Kiss (3), Jitka Elznicová (2), Martin Faměra (1)

(1) Institute of Inorganic Chemistry, Academy of Science of the Czech Republic, v.v.i., Řež, Czech Republic
(2) Faculty of Environment, J. E. Purkyně University in Ústí nad Labem, Czech Republic
(3) Faculty of Geography and Earth Sciences, University of Szeged, Hungary
* corresponding author, hosek@iic.cas.cz

Abstract
In the recent years researchers have enjoyed noticeable improvements of portable analytical and geophysical methods, which allow studying floodplain architecture and deciphering pollutant distribution more easily than ever before. Our area of interest was floodplain of the Ploučnice River, particularly a pollution hotspot in Boreček, severely impacted by U mining between the 1970s and late 1980s, in particular a “radioactive flood” in 1981. In the area, we used hand drill coring and in situ (field) analysis of so acquired sediments by handheld X-ray fluorescence spectrometer (XRF), which gave us information about depth profiles of pollutants (Ba, U, Zn) and the Al/Si and Zr/Rb ratios, i.e. proxies for sediment lithology. We found that spatial distribution of pollutants (control by depth and position in the floodplain) is apparently complex and discontinuous. In some places, contamination is buried by a couple decimetres of less polluted sediments, while in other places the peak pollution is near surface, apparently without a straightforward connection with the surface topography and the distance to the river channel. We thus examined the floodplain architecture, the internal structure of the floodplain using two geophysical methods. First of them, dipole electromagnetic profiling (DEMP, also denoted EMP, MP, or Slingram) quickly acquires average electric resistivity in top strata in selected areas, which was actually top 3 m with our particular instrument. Second, electric resistivity tomography (ERT) produces much more detailed information on resistivity with depth resolution of ca 0.5 m to the depth of ca 5 m in selected lines. ERT thus allows identifying boundaries of electric resistivity domains (sediment bodies) and DEMP their spatial distribution. Based on the obtained data, we divided the floodplain to five segments with specific topography, pollution characteristics, and electric resistivity. We suppose that those segments are lithogenetic floodplain units. Those findings must, however, be checked by sediment examination and analysis in selected points. We processed the crucial characteristics obtained by geochemical mapping, namely depth of maximum pollution, amount of contamination, and lithology (Al/Si and Zr/Rb ratios), using geostatistics. Moreover, some parts of floodplain were dated by optically stimulated luminescence (OSL) which revealed, that recycling of top decimetres of floodplain fine fill (silts) in Boreček site has proceeded relatively recently (in decades and centuries) as compared to deeper lying coarser (sandy) strata (millennia). The results of geochemical mapping show complexity of pollution hotspots and need of their integrated interpretation.
Key words: Dipole electromagneting profilling, electric resistivity tomography, floodplain contamination, geochemical mapping